

SEMANTIC-CLOUD ARCHITECTURE FOR MOBILES AN INTEGRATION OF SEMANTIC WEB, CLOUD AND MOBILE APPLICATIONS

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ABSTRACT

This paper highlights and outlines the architecture of Semantic web and cloud for mobile applications, a blend of two emerging web technologies, semantic web and cloud computing, for revolutionizing data access and processing capabilities over mobile platform. The emphasis lies on decoupling of data processing and data management from mobile hardware, usage of cloud for storage and transmission and thus exploring new opportunities that semantic cloud in mobile applications may promise to offer. This paper provides the context for the integration of three technologies and speaks technical details for the transition of technology to information.

KEYWORDS: Semantic Web, Cloud Computing, Semantic Cloud for Mobile, Mobile Cloud, RDF, Semantic Cloud

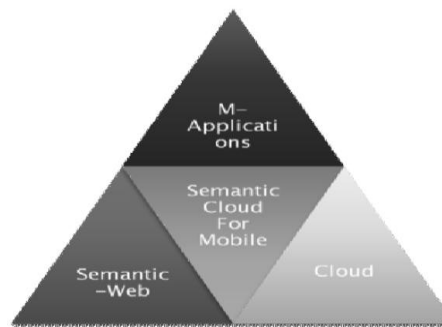
INTRODUCTION

The Semantic Web is a Web of data one might conceive of. It is generally built on syntaxes which use URIs to represent data, usually in triples based structures, or interchanged on www using a set of particular syntaxes developed especially for the task called RDF (Resource Description Framework) syntaxes. RDF provides the foundation for publishing and linking your data. Semantic web also makes use OWL to build vocabularies, or “ontologies” and SKOS for designing knowledge organization which enrich data with additional meaning and which enhance the web search, thus making the search program look for compact and more relevant content on web. Query languages go hand-in-hand with databases.

SPARQL is the query language for the Semantic Web. Cloud computing on the other hand refers to the computation done through Internet, i.e. allowing users to access database resources via Internet, without the need for maintenance of these resources, thus empowering the use of dynamic and scalable databases. Cloud computing provides the facility to access shared resources and common infrastructure, offering services on demand over the network to perform operations that meet changing business needs. The location of physical resources and devices being accessed are typically not known to the end user. It also provides facilities for users to develop, deploy and manage their applications ‘on the cloud’, which entails virtualization of resources that maintains and manages itself.

Mobile technology gives the power to access information anywhere from any device and at any point of time. As the mobile phones guarantee portability, ability to handle, transportability, and great performance, its use as an information retrieval platform can promise the scope for a huge market. Incorporating the former two technologies, i.e. the SEMANTIC WEB & CLOUD on mobile platform may cater the need for efficient, semantic access to cloud data on mobile.

3T-INTEGRATION



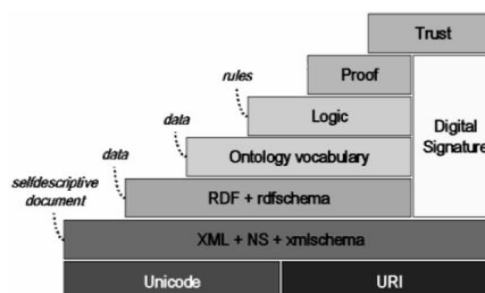
(Source: Paper published in an International Journal of CS on “Semantic Web”)

Figure 1: 3T-Integ

Mobile Subscribers according to a new statistics are 7.2 Billion by 2012. The number of subscribers using the internet on their mobile phones is expect to nearly triple from 577 million today to more than 1.7 billion by 2013, according to a new report from Juniper Research. .With the emergence of 3G, 4G and mobile Internet, there is an urgent requirement for IT support systems to provide mass storage space and fast computing capacity. The pace at which the mobile technology is spreading, the digital world is putting all its focus on development of and for mobile platform. Though the cost of hardware is decreasing, the decoupling of data storage, processing and management from mobile hardware will enhance performance, scalability and agility. The cloud is the future of the mobile. The dependency on hardware can be reduced manifold by moving the data and processing on cloud, which offers high performance, low cost and high scalability features along with processing management and storage capability for mass data, without the hassle of worrying about mobile hardware configuration. Hosting on cloud also relieves user from the risk of losing important data due to system crash, hardware malfunctioning, virus attack, etc.

SEMANTIC WEB V/S. CLOUD

However, cloud computing faces a number of issues including privacy, data integrity, data security, authentication, identification of access rights, low information quality, ambiguity and design problems due to disparity in database development models, used by cloud providers. Here, semantic web comes to the rescue. Semantic web provides a framework for control of the usage of cloud. The unified RDF can replace the disparate cloud database models. By using ontology, semantic web aims at collecting structured information from web pages and redirect the information to client side to cater needs and preferences of the individual users. Semantic web also reduces cost and complexity of cloud computing by the use of rules laid down in RDF. The issue of security, one of the major roadblocks in the success of cloud computing, is resolvable by a wide range of security mechanisms that the semantic web provides.



(Source: Paper published in an International Journal of CS on “Semantic Web”)

Figure 2: Shows the Suggested Architecture of Semantic Cloud

Explanation

Simple Data Modeling: Schemata: The first "layer" of the Semantic Web is the simple datatyping model. A "schema" (plural "schemata") is simply a document or piece of code that controls a set of terms in another document or piece of code. It's like a master checklist, or definition grammar.

RDF & RDF Schema: RDF is a standard model for data interchange on the Web. RDF has features that facilitate data merging even if the underlying schemata differ, and it specifically supports the evolution of schemata over time without requiring all the data consumers to be changed. RDF extends the linking structure of the Web to use URIs to name the relationship between things as well as the two ends of the link (this is usually referred to as a "triple"). Using this simple model, it allows structured and semi-structured data to be mixed, exposed, and shared across different applications.

This linking structure forms a directed, labeled graph, where the edges represent the named link between two resources, represented by the graph nodes. This graph view is the easiest possible mental model for RDF and is often used in easy-to-understand visual explanations. RDF Schema was designed to be a simple data typing model for RDF. Using RDF Schema, we can create properties and classes, as well as doing some slightly more "advanced" stuff such as creating ranges and domains for properties.

Ontologies, Inferences, and DAML: DAML is a language created by DARPA as ontology and inference language based upon RDF. DAML takes RDF Schema a step further, by giving us more in depth properties and classes. DAML allows one to be even more expressive than with RDF Schema by providing some simple terms for creating inferences. The OWL 2 Web Ontology Language, formally defined meaning for web, provide classes, properties, individuals, and data values and are stored as Semantic Web documents. They can be used along with information written in RDF, and they themselves are primarily exchanged as RDF documents.

Inference: Near the top of the Semantic Web stack one finds inference, reasoning over data through rules. W3C work on rules, primarily through RIF and OWL, is focused on translating between rule languages and exchanging rules among different system. Inference is one of the driving principles of the Semantic Web, because it will allow us to create software applications quite easily.

The Power of Semantic Web Languages: The main power of Semantic Web languages is that anyone can create application simply by publishing some RDF that describes a set of URIs. We have already seen that RDF Schema and DAML are very powerful languages for creating languages.

Trust and Proof: The next step in the architecture of the Semantic Web is trust and proof. Putting the data on mobile cloud, and offering a comfortable, semantic search experience to patients may relieve them off the time consuming, exhaustive search, while Xml encryption and Security Assertions Markup Language can take care of query privacy and data authentication respectively.

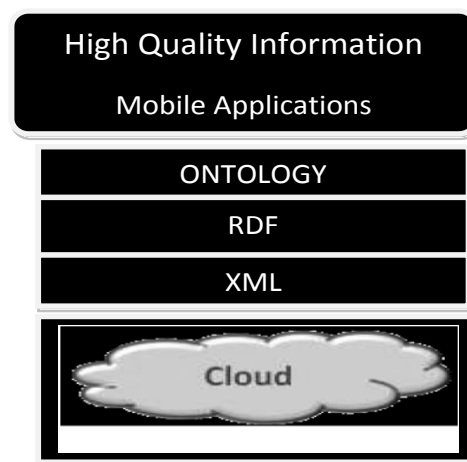
XML Key Management Specification: XKMS uses the web services framework to make it easier for developers to secure inter-application communication using public key infrastructure (PKI). XML Key Management Specification is a protocol developed by W3C which describes the distribution and registration of public keys. Services can access an XKMS compliant server in order to receive updated key information for encryption and authentication.

Security Assertion Markup Language: SAML is a XML-based open standard for exchanging authentication and authorization data between security domains, that is, between an identity provider (a producer of assertions) and a service provider (a consumer of assertions).

SAML is a product of the OASIS Security Services Technical Committee and it is trying to solve the Single Sign-on Problem. SAML assumes the principal (often a user) has enrolled with at least one identity provider. This identity provider is expected to provide local authentication services to the principal. Thus, a service provider relies on an identity provider to identify a principal. At the principal's request, the identity provider passes a SAML assertion to the service provider. On the basis of this assertion, the service provider makes an access control decision.

WHY SEMANTIC WEB RATHER WWW

Semantic web as the resort to know the meaning of Web or the machine language of WWW or Web one has to prefer over simple Web.



(Source: Paper published in an International Journal of CS on “Semantic Web”)

Figure 3: Shows the form of Semantic Web

From the cloud, structured information is retrieved using XML, semi-structured information and metadata model is retrieved using RDF and the relationship is added to the nodes using ontology. Finally the high quality information is transmitted onto the mobile application

APPLICATIONS

The goal of Semantic Cloud for mobile is to develop secure and faster applications in mobile. The applications include solutions to several problem domains such as attendance of University/College Students, notification about the lectures and seminars to the students, managing inter-collegiate festivals and conferences, aiding decision making in clinical research, to improve collaboration, research and development in life sciences and innovation in every domain etc. Widely speaking, the applications can be designed to serve the following:

- M-commerce
- M-health
- E-tourism
- e-learning and
- E-Governance

The new applications are up to the creativity of the developers ranging from m-Content development to m-computational knowledge Engine.

CONCLUSIONS

Semantic Cloud application is usable on any mobile device, which supports a suitable browser, independent of its operating system and hardware configurations. Besides this, it also guarantees low cost of deployment and development. Features like Html5 allow application to continue even if internet connection fails. It promises to offer a huge market with large revenue for developers, as the percentage of mobile Internet users seems to escalate exponentially with time.

The discussed approach is gradually shifting the focus of mobile from technology to high quality information provider by standardizing event processing, placing the seeds of semantic technology in the current technical ground, and establishing a self-sustaining process of transformation to semantic cloud architecture. Database as a Service (Dbaas) is already a very real option for many problems, the cloud is already making its impact and we are likely to see this impact rapidly grow. The semantic web has proved to be of great use although adoption is not currently wide there is a definite need. Research already describes the impact RDF has on databases, as we move forward it is possible that we are going to witness a more specialized database or a highly functional hybrid.

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